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THE MAGPIE IN RELATION TO AGRICULTURE

BY

E. R. KALMBACH

Biologist, Division of Food Habits Research
Bureau of Biological Survey

U.S. DEPARTMENT OF AGRICULTURE
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In the West the magpie [1] is regarded much as is the crow in the East. Both birds are notoriously resourceful, and the rôles that each plays are in many respects similar. Both birds—the crow in two centuries or more and the magpie in a much shorter period—have learned to adapt themselves to conditions altered by advancing settlement. The magpie especially has not been backward in adjusting itself to the conditions surrounding the pioneer rancher's cabin and in making its influence felt. Among those who have come into direct contact with it, opinion regarding the magpie is usually adverse, a natural result in the case of any bird possessing some outstanding faults.

There has been lack of definite information, on the other hand, concerning the insectivorous habits and other beneficial influences of the magpie. To assist in reaching a comprehensive and accurate decision regarding the worth of the magpie, the Biological Survey has been collecting data on its life habits over a series of years and has made field studies of the bird in representative localities throughout its range. The writer has examined an extensive series of magpie stomachs and has endeavored to evaluate and present impartially all the evidence at hand. By this means a scientific basis may be provided for an appraisal of the economic value of the bird.

[1] The term "magpie," as used in the main part of this bulletin, applies to the common black-billed form (*Pica pica hudsonia*). The yellow-billed magpie (*Pica nuttalli*), a less abundant species living in the San Joaquin-Sacramento Basin of California, is mentioned briefly on page 28. This bulletin presents and analyzes the data obtained from stomach examinations in the laboratory and from observations made in the field and gives suggestions regarding measures for use in areas where the control of magpies is necessary.

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FIG. 1.—BLACK-BILLED MAGPIE

The common magpie (*Pica pica hudsonia*) is characteristic of western landscapes. A closely related species with a yellow bill (*Pica nuttalli*) is of irregular occurrence in a restricted area in California. (From a painting by E. R. Kalmbach)

DISTRIBUTION OF THE MAGPIE

The common magpie (*Pica pica hudsonia*) shown in Figure 1 is a characteristic bird of the West and Northwest. (Fig. 2.) Intensive agriculture no doubt has been a contributory cause in the gradual westward withdrawal of this species since the middle of the last

FIG. 2.—Distribution of the black-billed magpie in North America. The shaded portion covers not only the breeding range of the bird but also contiguous areas into which the magpie wanders in sufficient numbers to make it of economic importance. The outlying dots designate records of stragglers

century, when the bird was common in the Dakotas, Nebraska, Kancas, Minnesota, and Iowa and not infrequent at points even farther east. The absence of magpies in the eastern United States, where environmental and food conditions appear to be favorable, is difficult to explain, especially in view of the habits of the common magpies of Europe, which thrive in a habitat similar to that in many locali-

ties of the Eastern States. That the American bird, however, is reclaiming some of the territory it formerly occupied is confirmed by reports from Montana and the Dakotas, to which States it has extended its range eastward in recent years.

At the present time the breeding range of the common magpie extends northwestward as far as the Alaska Peninsula and even beyond. From here southeastward to the northwestern part of British Columbia the bird is largely coastal in its distribution. Records at present available indicate a total absence or at least a great scarcity of magpies throughout the central part of British Columbia, but in the southern part of that Province they are common throughout much of the inland lake region. East of the Rockies, in the Canadian Provinces of Alberta, Saskatchewan, and Manitoba, the magpie becomes scarce northward. In the United States the eastern border of the bird's range is roughly marked by eastern North Dakota and western South Dakota, western Nebraska, and eastern Colorado. It has also wandered eastward to Indiana, Ontario, and Montreal in Quebec. To the south it reaches central New Mexico and northern Arizona and has straggled to central-western Texas. On the west a narrow strip along the eastern border of California and areas in Oregon and Washington westward nearly to the coast complete the limits of its range.

Within this range there are extensive areas where magpies are wholly absent or rare. Among these are the extensive alkaline desert areas of western Utah and Nevada and much of the heavily forested Canadian Zone and other higher faunal areas throughout its range.

LIFE HISTORY

The magpie is generally a resident the year round wherever it occurs, although in the extreme northern part of its range it is inclined to wander erratically after the breeding season. It is particularly partial to company of its own kind, not only during the breeding season but also at other times of the year. Often 10 or 15 nests may be found within a short distance along a "draw." In 1912 the writer collected 26 broods of young magpies in a distance of about a mile along a creek bottom near Kaysville, Utah, and once found two occupied nests in the same cottonwood.

In Colorado, Utah, California, and southern Oregon, egg laying begins before the middle of April, in Washington and Montana about two weeks later, while in the extreme northern part of the magpie's range it does not begin before June or even July. The nest, a bulky structure, sometimes 3 feet high and 2½ feet wide (fig. 3), is often completely arched with a bower of branches so thickly interwoven as to form an effective barrier against all but the most persistent enemies. This structure is frequently found in cottonwoods, willows, and hawthorns, usually at heights varying from 10 to 25 feet. When situated in a hawthorn and built of its twigs, the magpie's nest becomes a nearly impregnable citadel. An opening situated frequently on the side that is most difficult for human access permits entrance to the cup-shaped receptacle for the eggs. This well-formed interior is built up of smaller twigs, rootlets, and dry grasses more or less firmly cemented with mud. The nest proper is about 6 inches wide and 4

inches deep. Occasionally the magpie will use the same abode several successive seasons.

The eggs are usually 7 in number, though sets of 8 and 9 are not uncommon. A clutch of 10 was found by the writer in Utah in 1912. Considerable variation exists in the coloration, a dirty greenish gray being the prevailing ground color. This is rather profusely blotched with different shades of brown, sometimes completely hiding the ground color.

Unless the eggs have been destroyed or disturbed, one brood a season is usual. Incubation lasts from 16 to 18 days, and the young spend two to three weeks in the nest. For a few days before definitely leaving it, young magpies may be seen, in plumage similar to that of their parents, scrambling about the domelike top of their nest

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FIG. 3.—The magpie's nest is a bulky structure sometimes 3 feet in diameter and often completely arched over. Access to the interior is gained through an opening on one side. (Photo by H. W. Nash)

and on near-by branches. (Fig. 4.) As soon as their feathers have developed to a point where sustained flight is possible, young and old birds may be found in family parties on foraging expeditions. During the winter magpies sometimes establish roosts much after the fashion of crows, and in one instance these two species were found using the same small island in the Snake River in eastern Oregon as a place of nightly resort.

FOOD HABITS

MATERIAL EXAMINED

For the laboratory study of the food habits of the magpie 547 well-filled stomachs were available. Of these, 313 were of adults and 234

of nestlings. Twenty-two additional stomachs, in which the contents were too finely divided for accurate estimation of percentages, brought the total to 569. Although the extent of this stomach material is not all that could be desired for a thorough understanding of the magpie's food preferences, yet it is fairly representative of the bird's range and is well distributed throughout the year. From Utah came more material than from any other State, 201 stomachs being collected there, mainly in 1911 and 1912, when a study was being made of the relation of birds in general to the alfalfa weevil.[2] British Columbia is represented by 126 stomachs procured mainly at Okanagan Landing, Montana by 97, and Washington by 96. The remaining material was obtained from the following sources: Ore-

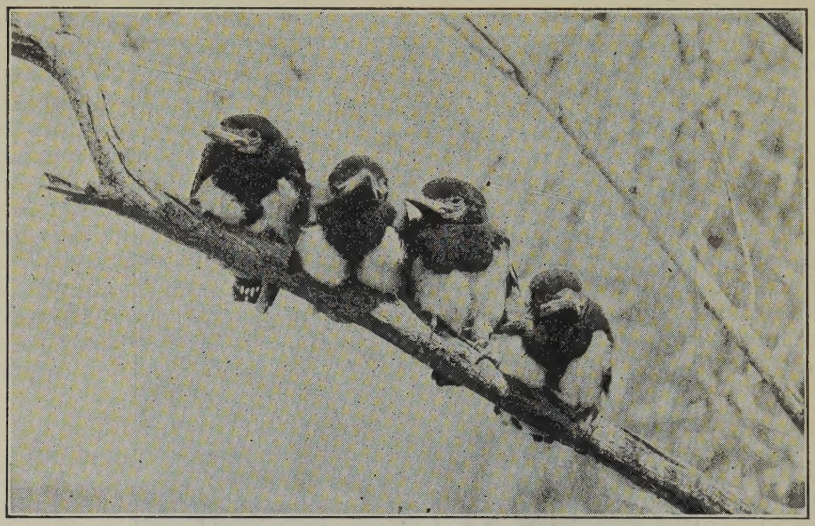

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FIG. 4.—Before the young are equal to sustained flight they may be found scrambling over the top of their dome-shaped nests or perched on near-by limbs

gon, 20; New Mexico, 8; Colorado, 7; Wyoming and Alberta, 4 each; South Dakota and Alaska, 2 each; and Idaho and North Dakota, 1 each. Nevada and California are the only States in parts of which the magpie is common that are not represented by stomachs. The nestling material came from Utah, Montana, and British Columbia.

The yearly cycle of food preferences can be shown approximately by the material at hand. Stomachs of adults were obtained in every month, the largest number in June, when 58 were collected. Other months were represented by the following numbers: July, 44; September, 32; April, 28; January and May, 27 each; August, 26; November, 23; October, 21; December, 17; February and March, 15 each. Of the nestlings 162 were collected in May and 74 in June.

[2] KALMBACH, E. R. BIRDS IN RELATION TO THE ALFALFA WEEVIL. U. S. Dept. Agr. Bul. 107, 64 p., illus. 1914.

FOOD OF ADULTS

ANIMAL FOOD

About three-fifths (59.8 per cent) of the food of the magpies examined was of animal origin. Figure 5 shows that the greatest consumption of animal food occurs during the magpie's breeding season in May. In this month weevils, ground beetles, hymenopterans, grasshoppers, carrion, small mammals, and a miscellaneous assortment of minor items comprised 92 per cent of the diet. A second period of increased consumption of animal food occurs in September, occasioned by the annual crop of grasshoppers, of which the magpie seems very fond. The additional animal food recorded in February was due primarily to an unusual consumption of small mammals by 7 of the 13 magpies used in the tabulation for this month. A larger series of stomachs doubtless would have eliminated the sudden increase in this item as indicated in the chart. November, December, and January mark the periods of smallest consumption of animal food.

INSECT FOOD

In its consumption of insect food the adult magpie compares favorably with other birds of the same family. Nearly 36 per cent of its annual food is from this source as compared with approximately 19 per cent for the common crow, 22 per cent for the blue jay, 26 per cent for the Steller jay, and 27 per cent for the California jay. In fact, it appears to be the most highly insectivorous of any of the common Corvidae in this country, and, if judged on this score alone, deserves considerable praise. Figure 5 clearly shows the magpie's insectivorous habits throughout the year. In addition to the sections representing weevils, ground beetles, caterpillars, bees and ants, and grasshoppers, about five-sixths of that portion referred to as miscellaneous animal matter consists of insect remains. These include miscellaneous beetles, flies, dragonflies, and insects of a few other orders. Taken as a whole, insect food is the dominating item in the magpie's annual bill of fare. For seven months of the year, April to October, inclusive, insect food exceeds any other single item, and in April, May, June, and September it exceeds all others combined.

In character, as well as in quantity, the insect food of the magpie speaks well for the bird. Weevils formed more than 2 per cent of the annual food. Bill-bugs (Sphenophorus) and the alfalfa weevil (*Phytonomus posticus*) were conspicuous ingredients of this portion of the diet. A study of the relation of the magpie to the alfalfa weevil in Utah in 1911 and 1912 revealed the adult birds as effective control agencies during the early spring days, when the hibernating insects were emerging from their winter quarters.[3] One such bird had eaten 181 adult alfalfa weevils. (Fig. 6.) Later in the season, also, the young birds assisted greatly in the consumption of the larvae. These birds, of course, were collected in areas heavily infested with the insect, and the results obtained must be considered most favorable for revealing the weevil-eating propensities of the magpie.

[3] KALMBACH, E. R. Op. cit.

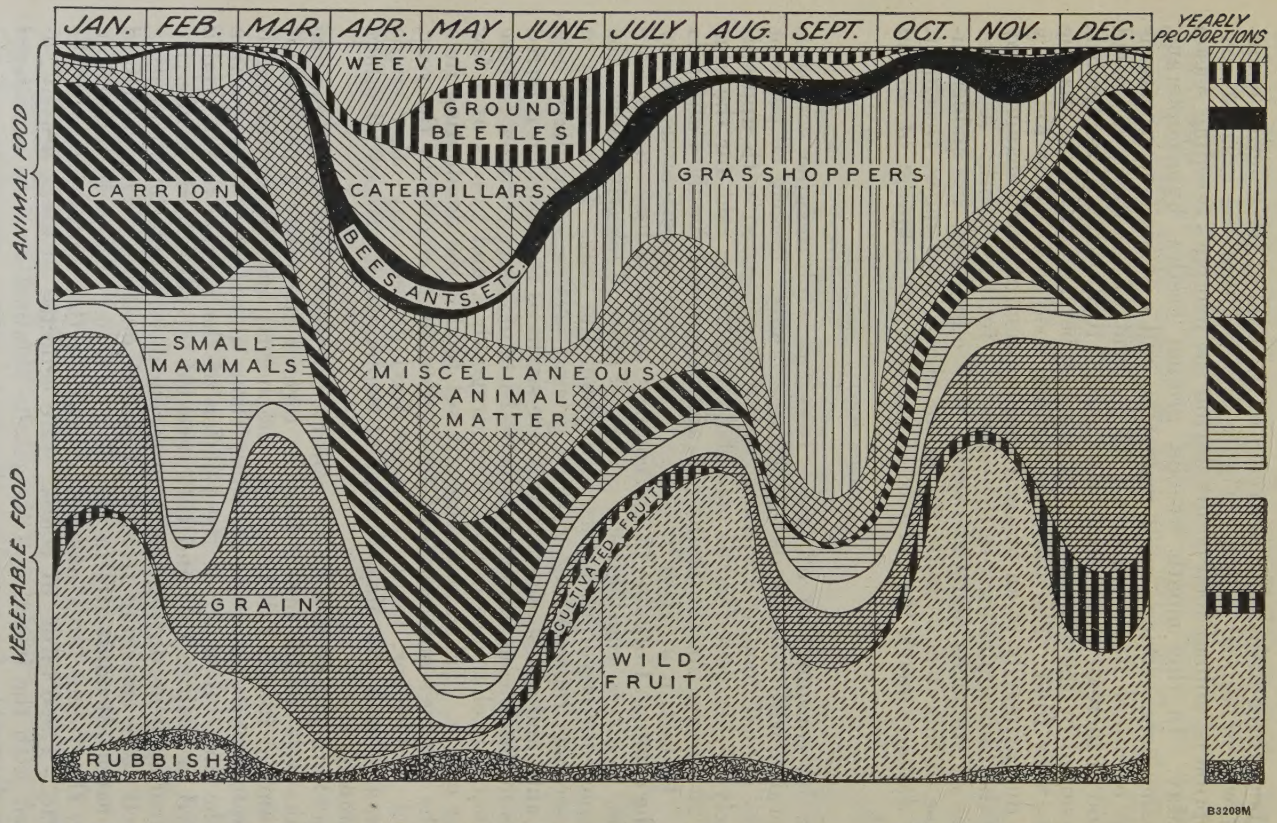

FIG. 5.—Principal items in the food of the adult magpie, showing the varying proportions of each, by bulk, from month to month and the relative proportion of each in the aggregate annual food; based on the examination of the contents of 313 stomachs. The percentage of each of these in the total food is shown in Table 1 (p. 9)

TABLE 1.—*Proportions (percentage of bulk) of the principal items identified in the food of the adult magpie*

[The proportions are graphically presented in Figure 5 (p. 8)]

Kind of food	January	February	March	April	May	June	July	August	September	October	November	December	Yearly averages
Weevils		0.08	0.47	11.52	5.08	5.12	1.11	0.84	0.76	0.20	0.18	0.20	2.13
Ground beetles	0.66		1.33	2.04	11.51	11.80	4.95	1.54	1.78	.05	1.00		3.05
Caterpillars	1.46		.47	13.24	16.97	3.85	1.39	1.71	2.17	.10	.14		3.46
Bees, ants, and other hymenopterans	.92	.31	.60	8.16	4.79	4.21	4.91	.92	3.62	2.55	6.60		3.13
Grasshoppers	.35	6.69	.26	.16	2.54	18.26	15.16	28.59	55.37	27.65	10.86	1.54	13.95
Carrion beetles [1,4]			8.93	4.20	1.08	2.30	3.02	1.17	.03	.40	.09	.73	1.83
Miscellaneous beetles [2,4]	.49		.13	2.96	18.71	5.15	6.29	6.43	2.42	2.60	.50	.14	3.82
Other insects [3] and spiders [4]	.58	.46	13.47	12.80	5.08	7.78	9.41	7.46	2.70	2.75	3.23	1.66	5.61
Mollusks, fishes, reptiles, and amphibians [4]			.87	1.08	.62	.48	.53	.36	1.00	.60	.59	.07	.52
Wild birds and their eggs [4]	.58					.16	1.25		.21			2.33	.38
Domestic fowls and their eggs [4]	.19		.07	.44	1.21	.21	.23		.07	3.25	.18		.49
Carrion	29.11	27.85	5.93	15.88	19.50	8.59	7.48	2.53	1.00	6.80	9.45	31.66	13.81
Small mammals	2.12	35.61	18.60	4.40	4.91	4.73	1.79	2.91	4.66	7.30	4.32		7.61
Total animal food	36.46	71.00	51.13	76.88	92.00	72.64	57.52	54.46	75.79	54.25	37.14	38.33	59.79
Grain	24.73	10.78	37.61	19.56	1.80	1.71	.07	2.50	8.18	6.75	15.32	32.00	13.42
Wild fruit	32.23	10.76	9.53	1.12	1.54	15.79	34.88	39.67	16.00	31.50	43.81	16.33	21.10
Cultivated fruit	1.43			.32	.16	7.86	4.68			7.25	1.68	11.27	2.89
Vegetable rubbish	5.15	7.46	1.73	2.12	4.50	2.00	2.85	3.37	.03	.25	2.05	2.07	2.80
Total vegetable food	63.54	29.00	48.87	23.12	8.00	27.36	42.48	45.54	24.21	45.75	62.86	61.67	40.21

[1] Silphidae, Histeridae, coprophagous Scarabaeidae, Dermestidae, and Staphylinidae.
[2] Elateridae, phytophagous Scarabaeidae, and others.
[3] Hemiptera, Diptera, Neuroptera, and others.
[4] All material listed under carrion beetles; miscellaneous beetles; other insects and spiders; mollusks, fishes, reptiles, and amphibians; wild birds and their eggs; and domestic fowls and their eggs is charted in Figure 5 as miscellaneous animal matter.

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Ground beetles (Carabidae) comprised more than 3 per cent of the diet and included both the highly beneficial predacious forms, as well as a large number of the smaller species known to be somewhat vegetarian in habits. Lepidopterous remains, almost entirely caterpillars, appeared in greatest quantity in April and May, when the adult birds were busily feeding the same sort of food to their offspring. In May, 17 of 24 adult magpies collected had fed on caterpillars, many of which were cutworms. These formed more than a sixth of the food. The hymenopterous food (more than 3 per cent) was characterized by an abundance of ants of various species and more than an ordinary number of the beneficial parasitic ichneumon flies. Crickets and grasshoppers, forming almost 14 per cent of the food, were conspicuous in the diet during the late summer and fall months. In this respect the magpie conforms with the feeding habits of the majority of ground-feeding birds, which turn their attention energetically to reducing the annual crop of grasshoppers at that time of year. In September more than half (55.37 per cent) of the bird's

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FIG. 6.—Half the meal of an adult magpie collected in Utah in May, 1910, consisted of adult alfalfa weevils—181 of these destructive pests—a point in the bird's favor

food consisted of grasshoppers and related insects. Particularly commendable work was done upon the western, or Mormon, cricket (*Anabrus simplex*), a staple article of the magpie's diet in the Northwest, especially in British Columbia. Insects associated with carrion formed a large portion of the remaining insect diet. These included short-winged scavenger beetles (Staphylinidae), carrion beetles (Silphidae), hister beetles (Histeridae), and flesh flies (Sarcophagidae), which were frequently found associated with flesh or hair, thereby contributing strong circumstantial evidence as to the condition of the latter when picked up by the bird. Bugs (Hemiptera), dragonflies (Odonata), and a few miscellaneous insects in small quantities complete the insect portion of the magpie's food.

Although literature does not supply so many records of the effective work of magpies on insect pests as it does with many other birds, yet the data obtained from stomach examination show that these birds may often be looked to for substantial aid in this respect. Their work on weevils, caterpillars, crickets, and grasshoppers is worthy

of commendation, and in many local outbreaks of one or another of these insects, magpies doubtless have an important controlling influence.

SPIDERS

Approximately 1 per cent of the annual food of adult magpies consists of spiders. Most of these are the large wolf spiders (Lycosidae), which secure most of their prey on or near the ground. The indiscriminately predacious habits of these arachnids probably result beneficially to agriculture.

MOLLUSKS, FISHES, REPTILES, AND AMPHIBIANS

The mollusks eaten by magpies consist mainly of small or medium-sized land snails. Fish, reptile, and amphibian remains are often picked up as carrion, though frogs and toads are probably attacked and killed by the birds. In one stomach were the remains of several young toads apparently swallowed one after another. The total quantity of these four items is about half of 1 per cent of the magpie's annual food.

WILD BIRDS AND THEIR EGGS

The magpie's aggressions against other birds are offenses primarily of the breeding season, and, as is the case with similar activities of other Corvidae, can be attributed largely to the need of supplying an abundance of animal food to rapidly growing young. A consideration of this phase of the bird's food preferences opens an important field of discussion that usually leads farmers, sportsmen, and bird lovers generally to an unqualified condemnation of the bird. Stomach examination affords corroborative evidence and indicates that the food requirements of the nestling birds are the principal cause of the magpie's behavior in this respect. It shows also that the serious cases of bird destruction reported against the magpie are probably localized or due to some peculiar environmental factor, as lack of cover for the birds attacked, an overabundance of magpies, or scarcity of other food. Such extenuating circumstances, however, should not absolve the magpie of blame.

On the basis of stomach analysis, this trait of the adult magpie does not appear particularly serious, since wild birds form only a little more than a third of 1 per cent of the annual diet, and were present in only 8 of the 313 stomachs used in the tabulation. In two other partly filled stomachs, not used in the tabulation of percentages, the remains of birds also occurred. In no instance could specific identification of the bird remains be made, although in two cases it was apparent that a small finch had been eaten. In only two of the stomachs of adult magpies examined were found the remains of eggs of native birds, those of a robin and what appeared to be those of a shorebird being recognized. Additional material might have been added to this category had it been possible to determine with certainty whether some of the food listed as carrion should really have been classed as birds captured alive. The presence of numbers of carrion insects in the stomach contents was the principal indicator of the carrion nature of the material.

The adult magpie's destruction of other birds and their eggs, as revealed by stomach analysis, seems hardly of sufficient consequence to warrant alarm. But when it is considered that the nestling young, which outnumber the adults at least two to one during the breeding season, consume about eight times as much of this food as their parents, this habit can not be lightly brushed aside. To careful observers it is apparent that some restriction on the magpie is justifiable where it is desired to increase small-bird life, especially in the vicinity of game preserves or in sections where magpies are unusually abundant.

Sportsmen generally accuse the magpie of making inroads on game birds, and in at least one western State officials in charge of the enforcement of game legislation have seriously considered and have even made plans for carrying out a state-wide campaign against the bird. It must be borne in mind, however, that a reduction in the numbers of the magpie is not the only requirement for a restoration of the former game supply. Influences inseparable from the advance of agriculture, such as drainage and the depletion of protective cover and food, have had their effect in reducing the game supply. Sportsmen themselves have a constantly increasing responsibility for the welfare of game, and they must not overlook their own culpability for present conditions while they endeavor to check the diminution of game through widespread anti-magpie campaigns.

DOMESTIC FOWLS AND THEIR EGGS

The magpie's visits to the poultry yard form the basis for the most frequent complaints against the bird from housewives in Western States. Although it does not have the physique to perpetrate the bold attacks on half-grown poultry that are made by the Cooper hawk and the crow, the magpie is especially troublesome to small chicks and eggs in unprotected nests. Stomach analyses show that the magpie's raids on the poultry yard are made chiefly to pilfer the nests. In only 2 of the 313 stomachs were the remains of chickens found, while shell of hens' eggs was disclosed in no fewer than 13. In bulk this food totaled about half of 1 per cent of the annual diet. Considerable irregularity was noted, however, from month to month, probably due to peculiar local rather than seasonal conditions.

Anyone who has had occasion to visit ranches in magpie-infested country is familiar with the nature of the bird's depredations on poultry. Often several hundred young chicks may be destroyed at a single ranch in one season; at one point in Colorado 100 young chicks were the victims of magpies in one day. Another report tells of the destruction of 11 of a brood of 13 within 48 hours from the time they were hatched. Such serious depredations can not occur, however, on ranches where young chicks and nests are carefully screened. At isolated spots where individual poultry yards receive the concentrated attention of all the magpies within a considerable area, screening of nests and chicks is the most economical and thoroughly effective remedy. It is equally effective on other ranches, but when damage is being inflicted by a local flock of magpies an inexpensive poisoning campaign frequently will put a stop to the trouble.

CARRION FEEDING AND ATTACKS ON LIVESTOCK

The magpie is recognized throughout the West as a notorious scavenger. Its smaller size, however, prevents its work in this direction being classed with the effective operations of the buzzards of the South. Furthermore, the magpie's propensity, closely associated with its liking for carrion, for attacking sickly, newly branded, young, or even healthy adult livestock (fig. 7) frequently causes ranchers, especially cattlemen and sheepmen, to consider the bird a pest of the most serious kind. Inasmuch as it is impossible in stomach examination to distinguish flesh and hair eaten as carrion from that taken from a live animal, and since some of the material here classed as carrion may belong to the latter category, the two are discussed together.

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FIG. 7.—Persistent attacks on injured and even healthy livestock, directed against the back, the eyes, fresh brands, or unhealed wounds, make the magpie a serious pest locally. (Photo by S. Stillman Berry)

Figure 5 shows that aside from a reduction in March there was a consumption of carrion in the various months such as would naturally be expected. There is almost a total absence of carrion consumption in September, when grasshoppers furnish an abundance of readily accessible animal food; throughout the winter it is an important item; and during spring and summer, with the exception of March, there is a nearly uniform diminution until the low ebb is again reached in September. Nearly 14 per cent of the adult magpie's annual food apparently comes from this source, and in December, January, and February it forms considerably more than a fourth of the sustenance. The presence in the stomachs of the hair of horses and cattle, the wool of sheep, and bristles of hogs, as well as the remains of some smaller mammals and even birds, indicates that the magpie will accept as food almost anything of animal origin.

As stomach examinations give no indication on the stock-molesting activities of magpies, evidence on this point must be obtained from field observation and from the experience of livestock raisers.

Aside from the financial losses involved in such depredations, the particularly cruel nature of these attacks on farm stock usually has made those who have witnessed them unrelenting enemies of the magpie. A fresh cattle brand or an unhealed wound of any kind furnishes the birds sufficient incentive for attack, and if the animal is not afforded protection it is likely to suffer a slow and most gruesome death. Calves have been blinded and even had their eyes removed by these voracious birds, and horses have been ruined by wounds inflicted by them. Even perfectly healthy sheep and hogs have been killed by these birds directing their attacks to the middle of the back. (Fig. 7.) Acts of this kind admittedly are sporadic, yet in some sections magpies seem to be becoming bolder and their aggressions more frequent. Possibly the more intensive handling of livestock is bringing to light cases that formerly passed unnoticed.

Characteristic of these attacks on sheep is one reported in an ornithological journal [4] to the effect that on a Montana ranch 15 of 350 rams kept in summer pasture were at one time suffering from magpie wounds, several of which died in spite of all that could be done for them. The sheep, which were placed in a pasture after shearing, were deprived of their normal protective coating of wool and thus were tempting objects to magpies. Accidental wounds with the shears were given as likely causes for the beginning of the attacks in this case; maggots of flesh flies attracted to the wounds aggravated the matter; and in some instances the wounds made in the lumbar region reached the kidneys, which were eaten. The observer reporting this case records another instance on the same ranch where two freshly branded cattle were attacked and the body cavity penetrated with fatal results for one and possibly both of the animals. A third instance occurring at the same ranch relates to the injury of six hogs caught in a storm and forced to lie down together for protection. Magpies attacked them in this position and tore holes in the back of each animal.

In 1920 a representative of the Biological Survey reported a number of instances of such predatory activities of magpies in Wyoming. Horses were forced to endure slow torture for four or five days before death relieved their sufferings. In the case of a cow an opening was actually made into the stomach before the animal succumbed. In 1917 one stock raiser in Utah reported the destruction of 17 head of cattle by magpies. These instances had come to his attention in the course of six weeks of severe winter weather. Another report from Utah, in 1920, recited attacks on 10 of 60 or 70 rams and on 2 or 3 cows in the course of two years.

In 1922 an appeal was made to the Biological Survey by ranchers in the San Luis Valley, Saguache County, Colo., for assistance in the control of magpies, which were said to have become one of the greatest problems with which the farmers had to deal. Even from as far east as the Rosebud Indian Reservation, S. Dak., has come unimpeachable evidence of the birds' depredations.[5] Saddle-sore horses were attacked and fed upon until they succumbed. Another more recent report from South Dakota, from the manager of a cattle

[4] BERRY, S. S. MAGPIES VERSUS LIVESTOCK: AN UNFORTUNATE NEW CHAPTER IN AVIAN DEPREDATIONS. Condor 24: 13–17, illus. 1922.

[5] REAGAN, A. B. THE BIRDS OF THE ROSEBUD INDIAN RESERVATION, SOUTH DAKOTA. Auk (n. s.) 25: 466. 1908.

company with extensive ranges in the Pine Ridge Indian Reservation, mentions the destruction by magpies of several hundred cattle each winter. After a campaign against coyotes had been conducted on these ranges and a large part of the magpies had been killed, losses of this kind ceased. Enough other reports have come to the attention of representatives of the Biological Survey in the course of their work in Western States to indicate that these attacks, though sporadic, constitute one of the gravest indictments against the birds and one that calls for drastic and prompt action to prevent serious losses. From the information at hand it would seem that this carnivorous habit is often indulged in to excess by a comparatively few birds of the vicinity, and that the elimination of these will solve the problem. Ranchers, therefore, should take summary action against the magpie at the first indication of such trouble, lest by the example of a few, other individuals become addicted to this predatory habit and the problem become more serious.

CARRIERS OF LIVESTOCK DISEASES

The magpie, along with the crow and turkey buzzard, is the object of frequent criticism because of the part it is alleged to play as a carrier of livestock diseases, particularly hog cholera. That the bird has certain capabilities in this direction there is little doubt, but it is also a fact that the reports have been greatly exaggerated and that often the bird has been blamed when there was no direct evidence to connect it with the spread of the disease. No data are at hand concerning the effect of the magpie's digestive tract on the virus of any of the livestock diseases, but if its action is at all comparable with that of the turkey buzzard there need be no fear of the distribution of disease through the feces. Regarding the possibility of distributing the virus of hog cholera on the feet or plumage of the magpie, attention might be called to experiments performed a few years ago on pigeons,[6] in which, after a most rigorous test, it was found impossible to transfer the disease in this manner. This series of experiments does not prove that hog cholera is never transported by birds, yet it does indicate that they are by no means as common carriers of the disease as some ranchers believe. Furthermore, the multitude of possible carriers among insect and animal life, aided by the elements, would tend to make the elimination of one carrier, the magpie, of little consequence in a campaign of hog-cholera control. Measures of strict sanitation, in which sick hogs are carefully quarantined and the bodies of dead ones properly disposed of, are to be stressed in the prevention of hog cholera, instead of attempts to eliminate a comparative few of a myriad of possible carriers.

MAGPIE AND COYOTE CAMPAIGNS

The flesh-eating habit of the magpie has placed it in a peculiar alliance with that arch enemy of the cattle and sheep industry of the West, the coyote. Aside from its own direct attacks on live-

[6] DORSET, M., C. N. MCBRYDE, W. B. NILES, and J. H. RIETZ. INVESTIGATIONS CONCERNING THE SOURCES AND CHANNELS OF INFECTION IN HOG CHOLERA. Jour. Agr. Research 13: 101–131, illus. 1918.

stock, this bird often has been the cause of failure of carefully laid poisoning or trapping campaigns against the coyote. The small meat baits for coyotes so frequently used about carcass decoys are equally attractive to magpies, and baited traps also are repeatedly sprung by magpies before coyotes have had access to them. As a result, campaigns of magpie extermination often must be carried out before successful work in coyote control can be conducted.

Although there is no great difficulty involved in removing locally these avian trouble makers, the process adds to the cost of coyote control. In one coyote campaign during the winter of 1920–21 in the vicinity of Ellensburg, Kittitas County, Wash., it was estimated that fully 5,000 magpies, constituting a disturbing factor of considerable magnitude, were killed in the course of the work. Its habit of picking up anything in the nature of meat fragments has always earned for the magpie the unqualified condemnation of trappers, whose carefully set traps for fur animals are often either deprived of their baits or sprung by the magpie in its effort to steal them.

SMALL MAMMALS

Magpies often appear in the rôle of scavengers in localities in Western States where poisoning operations are being conducted against rodents. There is also evidence that the birds at times prey upon small living wild mammals. In the destruction of injurious rodents, therefore, the magpie must be credited with doing good service. Among the small mammals included in its food are shrews, cottontail rabbits, meadow mice, deer mice, wood rats, house mice, jumping mice, pocket gophers, and ground squirrels. As nearly as could be determined, more than 7½ per cent of the magpie's annual food is procured from such small mammals. On account of the unusually large portion of the flesh of small mammals found in the stomachs of 13 birds collected in February the resulting percentage of this kind of food for that month is probably somewhat abnormal.

VEGETABLE FOOD

The magpie procures about two-fifths of its sustenance from the vegetable kingdom. Data obtained from stomach examination indicate that the bird is by preference carnivorous and that the vegetable portion of its diet is taken more or less as a matter of necessity and not from choice. Notwithstanding the fact that wild fruit of one kind or another is as readily obtainable in September as in August or October, the magpie's food preferences lead it to resort extensively to grasshoppers during that month and to reduce its consumption of wild fruit. There is every indication, also, that the grain eaten by magpies during the winter months is consumed largely as a matter of necessity. Grain could be procured in quantity during July and August at many points in the bird's range, but it turns naturally to an animal diet during those months. The rigorous weather of November, December, and January forces the magpie to adopt a diet that is more than 60 per cent vegetable, while in May the abundance of animal food permits it to reduce the vegetable portion of its diet to 8 per cent of the total.

GRAIN

The magpie can not be considered seriously injurious to grain crops. In this respect it differs markedly from two of its relatives—the crow, which is often a menace to grain both in spring and in fall; and the blue jay, which is troublesome at times to corn in the South. Although more than 13 per cent of the magpie's food is obtained from various cultivated grains, a surprisingly small proportion is taken during either the planting or the harvesting season. During the harvesting season of June, July, and August small grains average less than 1½ per cent of the total food. Most of the grain eaten was wheat, found in greatest bulk in the stomachs from British Columbia. Corn was present in only 10 stomachs and in insignificant quantity. The food chart (fig. 2) indicates that the bulk of the grain consumed by the magpie is waste, picked up in winter.

CULTIVATED FRUIT

Through its liking for cultivated fruit, the magpie occasionally becomes an important factor locally. This occurs most frequently as a result of its fondness for cherries. During June and July 7.86 and 4.68 per cent, respectively, of the food consists of cherries. Though these percentages are not large, it must be borne in mind that much of the material was collected in spots distant from cherry orchards. Stomachs of magpies collected in or about cherry orchards show unmistakably the frugivorous tendencies of these birds. Of nine birds collected in Colorado cherry orchards in June and July, all had fed on cherries, which constituted more than 62 per cent of the food. Field observations made at the time this material was collected indicated that there the magpie was second only to the robin as a cherry thief. Cultivated fruit other than cherries is eaten at times by the magpie, but by far the greatest portion of this is picked up as waste and frozen fruit in winter.

WILD FRUIT

Numerous fleshy wild fruits constitute the greater part of the magpie's vegetable food and often permit the bird to eke out an existence under conditions that at times become very adverse. More than 21 per cent of its annual food is derived from this source. It is present in the diet in quantities fluctuating from about 1 per cent in April to more than 43 per cent in November. It constitutes 39 per cent of the magpie's diet in August and 32 per cent in January. Were it not for the fact that a majority of the magpies collected in December had been shot in the grain country of British Columbia, a substantial consumption of wild fruit would doubtless have been recorded for this month also. A decrease in the quantity of wild fruits in September, compared with August, is explained by the counter attraction afforded by the annual crop of grasshoppers.

Among the wild fruits eaten are the buffalo berry (*Lepargyrea argentea*), elderberry (Sambucus), shad bush (Amelanchier), hawthorn (Crataegus), dogwood (Cornus), poisonous and nonpoisonous

sumacs (Rhus), wild cherry (Prunus), and currant (Ribes). A few acorns and mast from other sources also are eaten at times. In the consumption of such food the most important economic factor involved is the distribution of the seeds. This activity of the magpie may be considered of service in the perpetuation and spread of the wild fruits concerned. In disseminating the seeds of poisonous species the magpie, along with practically all other fruit-eating birds, must receive a certain measure of condemnation.

RUBBISH

Included under rubbish is a miscellaneous lot of vegetable fibers, which form nearly 3 per cent of the adult magpie's diet, material greedily and often unintentionally gulped down while the bird is taking other food. Its consumption has no economic significance.

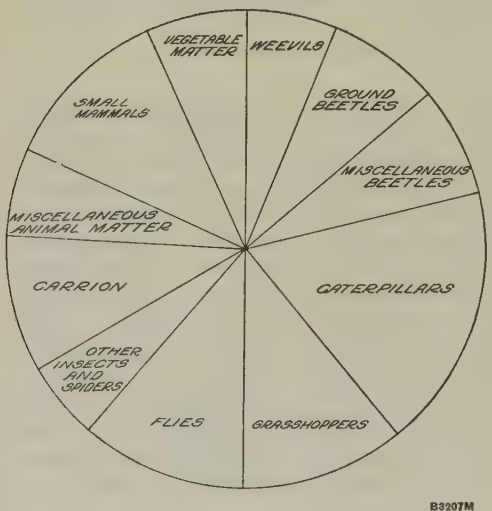

FIG. 8.—Principal items in the food of nesting magpies, showing the relative proportion of each, by bulk, in May and June; based on the examination of the contents of 234 stomachs. The percentage of each of these in the total food is shown in Table 2 (p. 19)

FOOD OF NESTLINGS

Examination of 234 stomachs of nestling magpies collected in May and June revealed food preferences differing somewhat from those of the adults collected during the same months, and decidedly from those of the parent birds taken at other seasons of the year. These nestlings were collected in Utah, Montana, and British Columbia—162 in May and 72 in June.

A study of the May and June food of magpies shows that the young obtain more than 94 per cent of their sustenance from the animal kingdom (see Table 2 and Fig. 8) as compared with 82 per cent for the parent birds. In the consumption of weevils, young and old render about equal economic service. In Utah, however, in 1911 and 1912, late broods were exceptionally active agents in the destruction of larvae of the alfalfa weevil. One such brood of six, favorably located, had eaten in the course of their last meal on the average more than 102 weevils apiece. Ground beetles are taken less frequently by the nestlings than by the adults, a fact controlled doubtless by the hard, chitinized character of these insects, which makes them less suited to the digestive system of the young. These insects made up about a twelfth of the nestling's food. Carrion beetles of various kinds, the plant-feeding scarabs, click beetles, leaf beetles, darkling beetles, and a number of other less important forms com-

prise in the aggregate about 7½ per cent of the young magpie's food, a little more than half the percentage of similar food of the parents.

TABLE 2.—*Proportion (by percentage of bulk) of the principal items in the food of nestling magpies in May and June*

[The proportions are graphically presented in Figure 8 (p. 18)]

Kind of food	Quantity	Kind of food	Quantity
	Per cent		*Per cent*
Weevils	5.84	Miscellaneous insects [3] and spiders	5.14
Ground beetles	8.12	Carrion	9.33
Carrion beetles [1]	4.09	Wild birds and eggs	3.18
Miscellaneous beetles [2]	3.44	Domestic poultry and eggs	1.78
Caterpillars	17.98	Miscellaneous animal matter [4]	.93
Grasshoppers	11.32	Small mammals	11.75
Flies	11.23	Vegetable matter [5]	5.87

[1] Silphidae, Histeridae, coprophagous Scarabaeidae, Dermestidae, and Staphylinidae.
[2] Elateridae, phytophagous Scarabaeidae, and others.
[3] Hymenoptera, Hemiptera, Neuroptera, and others.
[4] Included here are mollusks, fishes, reptiles, and amphibians.
[5] Chiefly rubbish.

Nearly 18 per cent of the nestling's nourishment comes from caterpillars, their pupae, and a few adult moths. This item is by far the most important in the young bird's diet and furnishes the strongest argument in its favor. Of the 234 stomachs of young magpies used in the tabulation, 171 had fed on lepidopterous remains. Many of the caterpillars were cutworms, some of which were doubtless from cultivated fields.

Grasshoppers, with a few crickets and katydids, comprise more than 11 per cent of the young magpie's food. Although the nestling period (May and June) is in advance of the annual crest of grasshopper abundance, stomach examination shows the young magpie to be an effective consumer of the western or Mormon cricket (*Anabrus simplex*), a fact shown strikingly in material collected in British Columbia. Thirty-seven of the 46 nestlings obtained from this Province had been fed on Orthoptera, chiefly western crickets. In bulk these insects formed nearly half the stomach contents and in two instances made up the whole.

Flies eaten by young magpies are principally flesh flies (Sarcophagidae) secured by their parents from carrion feeding stations. Most of those eaten were either in the larval or pupal stage—a comparatively few of the adult "bluebottle" flies being taken. The large number of maggots and fly pupae found in some of the nestling stomachs indicates that the parent birds visited carrion for the express purpose of procuring this insect food for their young, even in preference to the carrion itself.

In the consumption of other miscellaneous insects and spiders some differences are shown between the tastes of adults and nestlings, but in no case are these pronounced nor do they involve matters of great economic importance, especially since the percentages are small. In the case of spiders, the percentage (1.66) is somewhat less than is usually found in the stomachs of nestling birds. In the nestling crow the proportion is about six times as great.

Carrion constitutes nearly a tenth of the food of the nestling magpie, which is somewhat less than the average for adults for

May and June. Because of uncertainty in determining the exact nature of mammalian remains, it is possible that some of the material listed as small mammals should be considered carrion. It is apparent, however, that mammals, either captured alive or taken as carrion, are a most important source of food of the nestling magpie, the two items comprising more than a fifth of the food and being present in 164 of the 234 stomachs examined. The economic significance of so large a proportion of mammalian food and a consideration of problems arising in connection therewith are discussed under "Food of adults," pages 13 to 16.

The magpie's depredations on wild birds and domestic poultry may be attributed mainly to a desire to satisfy the appetites of its young. In analyzing the significance of such food items attention must be called to the fact that their bulk is never great even in the case of the most predatory species. Yet the percentage of such food in the stomachs of nestling magpies places these birds in the front rank of such avian offenders. More than 3 per cent of their food is procured from other wild birds and nearly 2 per cent from the poultry yard. In the former of these two offenses it is, on the basis of percentages, more than twice as culpable as the nestling crow. Accurate identification of avian remains could be made in only three stomachs of young magpies—birds that had been raised in the vicinity of the Bear River marshes, Utah, in 1916, and had been fed on coots, probably disabled by alkali poisoning.

In the small quantity of remaining animal and vegetable food nothing of great economic importance is involved. The bulk of the young magpie's vegetable diet consists of rubbish, greedily swallowed with the rest of its food.

Summarizing, it may be said that, compared with the adult magpie, the nestling bird must be credited with a considerably greater consumption of caterpillars and, wherever opportunity presents itself, of certain orthopterans as well. The flies eaten so extensively by the young are almost exclusively carrion-feeding species, generally considered useful in the reduction of putrid matter. For the magpie's attacks on other wild birds and on poultry the food preferences of the nestlings must be held largely to blame. As carrion consumers there is little to choose between parents and young, but in the destruction of small mammals the nestlings excel. Field observations indicate that the stock-molesting habit of the magpie is most frequently in evidence during winter and early in spring, although some of the depredations on newly sheared sheep may be provoked by the demand for animal food on the part of the nestlings. The young magpie's vegetable diet is essentially neutral in its economic significance, whereas the parent birds are known to damage cherries when opportunity presents. There is the possibility, however, that had nestling magpies been collected in the vicinity of cherry orchards a greater consumption of this fruit would have been revealed.

SUMMARY OF FOOD HABITS AND ECONOMIC STATUS

Stomach examination shows the magpie to be one of the most resourceful birds of the crow and jay family, to which it belongs. A total of 402 specifically different items detected in the examination of 547 stomachs gives some indication of the multitude of ways that

the magpie's influence may be felt. As an insect eater it has no superior among its immediate relatives. Its consumption of destructive weevils, caterpillars, and grasshoppers is a strong point in its favor. In its feeding on spiders, mollusks, fishes, reptiles, and amphibians there is little of economic significance, because of the small quantities taken. As an enemy of small mammals the magpie must be credited with the destruction of a certain, though limited number of noxious rodents.

Field observations have frequently indicated that the magpie is destructive to other bird life, and stomach analysis has in a measure corrobated the view. Domestic fowls and their eggs are sure to suffer in areas where magpies are abundant and poultry is not securely housed. As a carrion feeder the magpie deserves some commendation, but closely allied to this habit is its propensity for attacking livestock, which has brought upon it the practically universal condemnation of ranchers and cattlemen.

The vegetable food of the magpie is in the main economically neutral. Wild fruit forms the bulk of this; and the grain eaten is almost entirely waste, leaving cherries and a little late fruit as the only objectionable part of the magpie's vegetable food.

A decision rendered solely on the basis of the evidence obtained from stomach examination might logically consider the magpie one of the most beneficial of the Corvidae. Its shortcomings so revealed are rather similiar to those of the crow, while its beneficial insectivorous habits are more pronounced. Field observations, however, have produced evidence not definitely revealed by stomach analysis and also have indicated the proper interpretation to be placed on some of the data obtained from the stomachs.

The magpie is intimately associated with the livestock industry, and through this it establishes a direct medium of contact with man, be he cattleman or humble rancher. Consequently, in determining the economic status of the magpie its activities on the cattle ranch must be given consideration. Here it is almost universally condemned, and investigations have substantiated many of the charges made against the bird by ranchers. In such situations magpie control often may become necessary. Also in cases where the birds become troublesome to poultry raisers and where it is desired to maintain game and other birds in large numbers, as on preserves or game farms, the magpie must be controlled.

The magpie, however, is by no means an unmitigated pest. When in normal numbers and not inflicting noticeable damage, it may well be left unmolested to render the good services of which this study has shown it capable. The idea that the magpie, or any other bird, though often objectionable, is a proper object for control at all times is wholly fallacious. As time goes on and studies in the economic relations of birds advance, it becomes more and more apparent that the real need of bird control, though imperative at times, is primarily local in character. To meet such local needs the following section on economical and effective control measures is appended.

CONTROL MEASURES

In contrast with a number of other birds that are troublesome at times, the magpie is not particularly difficult to control when this

becomes necessary. Several factors contribute to this. Since the bird is a resident the year around, it is possible to conduct control campaigns against it during periods of severe winter weather, a time when baits of almost any description are acceptable. At this season also the magpie population tends to concentrate in certain favorable feeding areas, with the result that all the magpies of one or more creek bottoms may congregate on a few ranches. Although exhibiting to a certain degree that fear of a poisoned area so marked in the crow, the magpie is more or less careless in the matter of picking up poisoned baits. Hence, by taking pains to have poison stations scattered, and by shifting each one after a few days' operation, there should be little trouble in practically extirpating the magpies of a particular section. In addition, the magpie, in common with many other birds, does not exhibit that pronounced aversion to the bitterness of strychnine that constitutes an important obstacle in operations against mammals. This factor greatly simplifies the preparation of baits and makes the problem primarily one of proper field procedure.

An idea of the degree of success that may be expected from a well-planned magpie campaign has been obtained in connection with some of the operations against predatory animals conducted by the Biological Survey in Western States. During campaigns against coyotes in the winter of 1921–22 along Butter Creek, in Umatilla County, Oreg., it was conservatively estimated that 5,000 magpies were killed. In Douglas County, Colo., magpies were practically exterminated in the country covered by poison lines placed for coyotes in the winter of 1922–23. In the winter of 1921–22 a coyote campaign planned on the Pyramid Lake Indian Reservation, Nev., called for preliminary measures against magpies. On the first day after placing the baits three grain sacks full of dead magpies were picked up. An inspection of this reservation during the following winter showed not a dozen magpies, where in the previous year there were probably more than a thousand. At one poison station at Summit, Utah, 143 of these birds were accounted for within a few days.

Notwithstanding the fact that the common magpies are not averse to feeding on simple strychnine baits, control operations present one problem to which thorough consideration must be given. This is the possible destruction of harmless or even beneficial bird and animal life through the careless distribution or improper choice of baits. The same difficulty presents itself in practically every effort at bird control, and it is only by the choice of proper baits and the use of intelligent methods of distribution that the killing of innocent species can be prevented. The safeguarding of these species is imperative not only on strictly economic grounds, but also because in many cases to destroy them would violate Federal or State laws affording them protection. Of equal importance is the danger of killing valuable dogs and even livestock through carelessness in control operations.

A case in point has been reported from Oregon, where a piece of poisoned salt pork rind was nailed to the top of a tall but weak post standing in a cattle corral. This with several other similar baits accounted for the death of more than 90 magpies within the first 24 hours of exposure. Later a cow pushed the post over, and, attracted

to the pork because of the salt in it, received a fatal dose of strychnine. Subsequently, the ranch dog, finding the remainder of the pork rind, made away with it, also with fatal results.

The study of the magpie's food habits has shown the bird to be primarily carnivorous. Consequently, it would seem logical to employ animal baits in the form of meat or fat of some kind to convey the poison. That this supposition is correct was demonstrated by experimental control work conducted by the writer in Colorado in the winter of 1923–24. In many localities animal baits, prepared and exposed in the proper manner, can be employed with comparative safety to wild or domestic birds and mammals. Open plains country is usually lacking in the small birds that would feed readily on meat baits. Even river bottom lands dotted by only occasional cottonwoods or willows may be baited with meat baits with comparative safety, but in areas that abound with woodpeckers, nuthatches, chickadees, and other birds that readily feed on suet or fat, animal baits should not be employed. Nor should such baits be used in situations where they can not be placed out of the reach of certain poultry, especially turkeys, ducks, and geese, as well as of domestic cats and dogs. Under no circumstances should carcasses or large chunks of meat be poisoned and exposed. Even the poisoned pork rind, which often is effective against magpies, has produced unfortunate results when not securely fastened to its support.

CARRION STATIONS

Carrion is an excellent lure with which to attract magpies and is almost certain to be found a few hours after it is exposed. A beef or horse carcass may be conveniently divided into portions sufficient for 15 or 20 magpie stations, and smaller carcasses into a correspondingly less number. The exposed body of a chicken or rabbit will be found just as readily as that of a large mammal, with the advantage of easy removal when it has served its usefulness or when there is need to change the location of a station. It will be necessary to inspect regularly a station consisting of the body of a small mammal or chicken lest the magpies consume it entirely and deprive the station of its lure.

All carcasses, large or small, should be opened or have a section of the skin removed in order that the birds may gain ready access to the flesh. In cases where the decoy carcass has been exposed to drying atmosphere or has been frozen and the flesh made difficult to remove, the addition of a few fragments of suet, scattered about the station will tend to restore the popularity of the feeding ground. Advantageous points for such carrion stations may be found along fence lines around cattle corrals or pastures (fig. 9), or near railroad tracks, areas to which the magpies is partial. The vicinity of streams also affords excellent sites for bait stations, provided the more heavily timbered areas that harbor numbers of small insectivorous birds are avoided. The barren sand bars of shallow streams frequently dotted with driftwood, on which the poisoned bait may be displayed, afford excellent and safe localities for carrion station. (Fig. 10.)

The periodic shifting of stations is a prerequisite to successful magpie control, especially in periods of fair weather, when the attraction of a station is none too strong. It is for this reason that small

carrion stations are preferred to those that are difficult to shift. During the fair warm days of early spring a carrion station with its bait will retain its maximum effectiveness for about three days. During colder weather it will last longer. A shift of a few rods, when accompanied by a new arrangement of carrion and bait, will often rejuvenate a station and make it effective over another period of time, varying with weather conditions. It is also advisable to remove all dead magpies from the vicinity of the station once or twice daily.

SUET BAITS

Beef suet makes excellent magpie-bait material because it is easy to obtain, can be handled conveniently, will keep for a long time in cool weather without objectionable odor, and is perfectly acceptable to the magpies, especially when the bait has been slightly red-

FIG. 9.—A typical rendezvous for magpies. Poison baits set about such cattle corrals are readily taken by the birds congregating there

dened by the addition of a small portion of red meat. To prepare strychnine-suet bait, the fat should first be put through a meat grinder having a fine knife. Power grinders in which the fat is ground in the form of shreds about an eighth of an inch in diameter are well suited for this purpose; the first grinding can be done at the market when purchased. Subsequent mixing and grinding can be done with the ordinary household grinder, some types of which turn out a product similar to that of the power machines. Household grinders can be cleaned perfectly by the plentiful use of boiling-hot soap solution, which will melt and dissolve all fat-carrying particles of strychnine. A subsequent rinsing with hot water will thoroughly cleanse the grinder.

Two pounds of suet will produce, when ground, about 1¼ quarts (liquid measure) of suitable magpie bait. The suet should be ground when cool so that the product will break up readily into small par-

ticles. This material should be spread out in a thin layer, preparatory to adding one-eighth of an ounce of powdered strychnine alkaloid. An even distribution of the poison may be obtained by first mixing the strychnine with an equal bulk of flour to give it additional volume and then dusting this mixture over the suet by means of a salt shaker. After the strychnine-flour mixture has been evenly distributed over the surface of the suet particles, it should be molded into the fat, the warmth of the hands being sufficient to soften the suet if small portions are worked at a time. The object is to embed, if possible, all particles of strychnine in the fat. After this has been accomplished the fat should be passed through the grinder again and with it about a teacupful of any red meat to give the resultant product color. The meat and suet should be fed alternately into the grinder in small quantities to produce an even mixture. The second grinding, as in the case of the first, should be done when the suet is

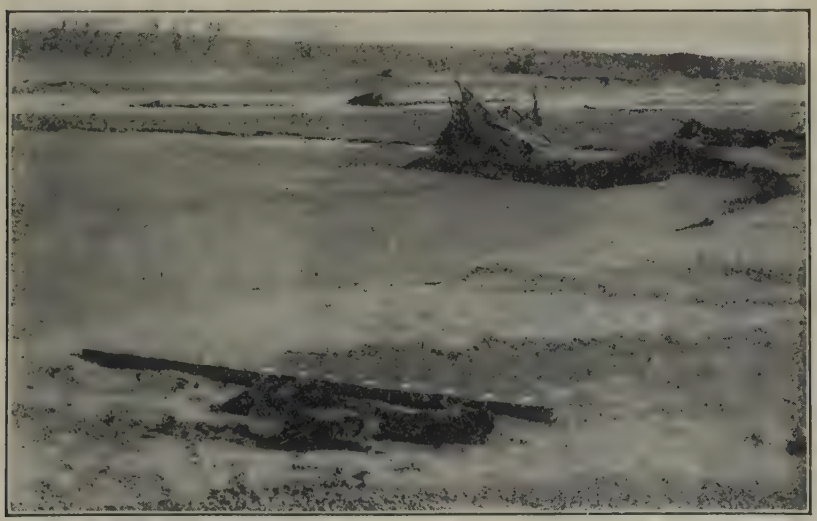

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FIG. 10.—In places where there is no danger of killing valuable dogs, a "suet stick" (see fig. 11) may even be placed on the ground. The carcass of a chicken is an effective decoy in local poisoning campaigns against magpies

cool, to insure a product in which the particles will remain more or less separated. This bait should be stored in covered tin receptacles in a cool place until ready to use.

Suet baits may be safely exposed in what may be termed a "suet stick." (Figs. 10 and 11.) This may be made from a section of 2 by 4 or board of equal thickness and of a length convenient to handle, a 6-foot length being satisfactory. Ten or 12 holes, 1½ to 2 inches in diameter and about 1½ inches deep, should be bored into it at 6-inch intervals. These holes serve as convenient receptacles for the poisoned bait, which should be molded into them rather firmly but not with pressure sufficient to destroy the more or less granular condition of the suet. Special care must be taken not to impress the suet too firmly in periods of severely cold weather, when it is liable to solidify to a point where even so powerful a bird as the magipe may have difficulty in removing particles.

The suet stick may be conveniently fastened by nailing it horizontally across the top of a tall, strong fence post and wiring the two ends down to some point at about the middle of the post. Placed in this manner it furnishes a convenient perch on which the birds may alight, and when a carrion station is placed directly beneath, the baits are often seen and taken before the carrion is sampled. These sticks may also be safely wired to horizontal limbs of trees close to the carrion station or to the framework of hay poles, or nailed to the roofs of buildings to which poultry do not fly. Where one has opportunity to watch a station, in order to keep away all animals except magpies, these suet sticks may safely be placed on the ground beside the carrion, where they will be even more attractive than when elevated above it.

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FIG. 11.—"Suet stick" used for exposing strychnine-poisoned suet baits. Elevated on tall fence posts they make attractive and readily used perches for magpies, and the poison is thus effectively placed without danger to livestock. A suet stick may be used on the ground beside a carrion lure in areas where there is no danger of killing valuable dogs, or where the station can be constantly watched (fig. 10)

Away from ranches, where there is no danger of killing valuable dogs, scattering suet baits directly on the ground in the vicinity of the carrion stations will give excellent results. The magpie has a pronounced tendency to take what is most accessible, provided it comes within the category of acceptable food; consequently, suet baits in the shape of small loose fragments will frequently disappear before the carrion station itself is touched.

Small particles of suet may also be exposed conveniently by impressing them into cracks at the tops of tall fence posts, where they are readily found by magpies.

The suet-strychnine bait here recommended is rather slow in its action, because the poison is retarded by being thoroughly embedded in the fat. This results in a large proportion of the birds dropping at points distant from the station, where they may be unnoticed in a hasty search. Although a bait with such a property is less satisfactory from the standpoint of visible results, it is thoroughly effective and has the advantage over more rapidly acting baits in that

there will be fewer dead birds about the poison station to act as deterrents to others.

Control measures against magpies should be conducted energetically and with the object of cleaning up the bulk of the birds in the course of five or six days. Daily visits should be made to replenish baits that have been eaten and to remove dead birds that have fallen in the immediate vicinity of the stations. When the magpies have been exterminated locally it will be well to remove all baits that may still be exposed.

VEGETABLE BAITS

Vegetable baits can be used to advantage in areas where small insectivorous birds abound and in situations where it is difficult to safeguard animal baits against dogs. By using whole Indian corn of large size as a bait the danger of killing small seed-eating birds is practically eliminated, and if the kernels are scattered widely in the vicinity of a carrion station the grain will have little attraction for livestock. As in the case of animal baits carrying strychnine, poultry other than chickens must be excluded from the poisoned areas. Domestic chickens, in common with quail, pheasants, sharp-tailed grouse, and prairie chickens, possess a marked immunity from the action of strychnine, and without ill effects can eat grain baits in considerable quantities of a strength great enough to kill magpies.

Since magpie-control campaigns can be most effectively conducted in winter, vegetable baits distributed at that time should be prepared so as to resist dampness and prevent the dissolving or washing away of the strychnine. Coating grain with a layer of tallow is one of the most convenient methods of accomplishing this, and although this involves the addition of animal matter to the bait, the quantity is so small and the poison conveyed by each kernel is so limited that when scattered sparingly there is little danger to dogs.

Such a bait may be prepared in the following proportions:[7]

2 quarts Indian corn (whole).
½ pint beef suet (ground through a meat grinder or thoroughly crushed).
⅛ ounce strychnine alkaloid (powdered).

The corn and ground suet are placed in a metal container set in a vessel of hot water. This is kept hot while the corn and suet are stirred until the latter is completely melted. The strychnine is then added and, after thorough mixing, the corn is cooled and spread out to prevent the kernels from sticking together.

Vegetable baits are most effective when distributed about regular feeding stations of magpies. At times conditions in the vicinity of corrals or cattle sheds furnish the necessary inducement. Carrion in the shape of a carcass is always an attraction, and about these stations the vegetable baits may be scattered. Additional small caches of bait, consisting of a few kernels of corn or flakes of rolled oats, may be placed on the tops of near-by fence posts, stumps, or bowlders, on which the birds would be inclined to alight on approaching the baited station. Above all, the bait should be used sparingly. An inspection of the stations should be made daily, if possible, to re-

[7] This method of coating the grain was used successfully in New Mexico in 1919 by H. E. Williams, of the Biological Survey.

plenish baits that have been eaten and to remove dead birds from the immediate vicinity of the decoy carcass or other baiting station.

THE YELLOW-BILLED MAGPIE

The yellow-billed magpie (*Pica nuttalli*) is of regular though local occurrence in a rather restricted area in the Sacramento and San Joaquin River Valleys of California. It occurs also occasionally throughout much of the southern part of western California. The bright yellow of its bill and the bare skin about the eyes, in addition to its smaller size, distinguish it from its more abundant, black-billed relative.

Only 23 stomachs of the yellow-billed magpie were available for examination, and of these 15 were collected in March and August. On the basis of what this limited material revealed, 70 per cent of the bird's food is obtained from animal matter and 30 per cent from vegetable. Insects comprise more than half the food (54 per cent), a somewhat better showing than that made by the common magpie. Conspicuous among these are grasshoppers, of which the bird apparently consumes large numbers late in the season. These insects formed nearly a fourth of the food of the 23 birds and nearly half the diet of the 11 that were collected in the grasshopper season of September and October. Bees, ants, and wasps made up 13 per cent of the diet; ground beetles a little more than 5 per cent; and flies, carrion beetles, and true bugs about 2½ per cent each. The remaining insect food was divided among a number of different orders, but in no case was anything of great economic importance involved. Spiders, present in 6 of the stomachs, formed less than 4 per cent of the food. Carrion, consumed largely in winter and early spring, furnished nearly 10 per cent, and the remains of a bird, in 1 stomach, a few snails, and remains of a fish (probably carrion) completed the animal portion.

In its vegetable food the yellow-billed magpie shows a greater preference than the black-billed for grain—wheat, oats, and barley. The 17 per cent of such food eaten, however, was mainly waste grain picked up largely after the harvest season. The birds possess at least a limited potentiality for damage in orchards and vineyards, indicated by the 6 per cent of cultivated fruit found in the stomachs and made up of figs and grapes. Although such fruit was found in only 3 of the 23 stomachs, the high percentages recorded indicate that when in favorable localities the birds will not hesitate to satisfy their appetites at the expense of the fruit or grape grower. Wild fruit, which constituted 5.13 per cent of the food, apparently is less attractive to the yellow-billed than to the black-billed species.

From the evidence at hand the yellow-billed magpie appears to be somewhat more insectivorous than the commoner species. At the same time it is capable of committing practically all the offenses of which the latter is so frequently accused. The present scarcity of the yellow-billed magpie, however, precludes the possibility of its doing serious damage. Its minor offenses can well be tolerated lest aggressive measures result in the actual extermination of an unusual species of restricted range.

SUMMARY

The common magpie (*Pica pica hudsonia*), a characteristic bird of the plains and mountains of the West, exerts an economic influence not greatly different from that of the crow of the East. Study of its food habits indicates that as an insect eater it surpasses the crow and, as far as is now known, has no superior in this respect among any of the North American Corvidae, a family of birds, including the jays, crows, and magpies. Destructive weevils, caterpillars, and grasshoppers characterize its insect food, which forms nearly 36 per cent of the bird's annual diet. The magpie also must be credited with the destruction of a certain though limited number of small rodents, and as a carrion feeder it also does some good.

On the other hand, the magpie has some outstanding faults. It is guilty of the destruction of poultry and beneficial wild birds and their eggs; it has at times become a pest on the cattle ranch by its attacks on sick, injured, or weak livestock; and has proved a nuisance and hindrance in campaigns against coyotes by feeding on baits or tripping traps set for these mammals.

There are times when these birds become so bold or gather in such great numbers that their faults become emphasized to the degree that a reduction in their numbers is warranted. Poisoning during the winter has been found to be an economical, effective, and safe method of accomplishing this. As in most if not all problems of bird control, the real need for drastic action against the magpie is confined to local areas where one or another of its faults has become unduly emphasized. Over much of its range, where it appears in moderate numbers, the bird is not an outstanding agricultural pest or a serious menace to other wild birds, and the present study has revealed the fact that there are times when its influence may even be decidedly beneficial. Consequently, extirpation of the bird over large areas is not called for, and before local campaigns of control are inaugurated careful consideration should be given to their necessity and scope.

The yellow-billed magpie (*Pica nuttalli*), confined to a small area in California, has habits similar to those of the common species, but its limited numbers obviate the necessity of control at the present time.

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